NATURAL RESOURCES DEFENSE COUNCIL

April 27, 2010

Phil Isenberg, Chairman
Delta Stewardship Council
650 Capitol Mall
Sacramento, CA 95814
(916) 445-4500

Re: **Packet of Information on Delta Issues**

Dear Phil Isenberg:

Thank you for your consideration of my comments at the Council meeting last week. As mentioned, NRDC worked closely with the Delta Vision Task Force and the legislature to create the Council. We look forward to working with you as you undertake the ambitious work of writing a Delta Plan. Again, congratulations on your appointment.

For your information, I have attached a packet of information on Delta-related issues. This packet includes:

- An article about the Delta in NRDC's OnEarth magazine.
- An op-ed in the Marin I-J discussing the water reform package that created the Council.
- An op-ed in the San Diego Union Tribune outlining NRDC's strategies to meet California's future water needs.
- An op-ed in the Riverside Press-Enterprise presenting our perspective on a Delta isolated facility.
- A fact sheet regarding key unresolved issues in the BDCP process.
- A report about the decline of the state's salmon fishery and the linkage to Central Valley water management.

I hope you find this packet useful.

One final note: I mentioned five key recommendations for the Council as you begin your work on a Delta Plan. During this week, I am writing about those recommendations in my blog – where I write regularly about water issues. I hope you can find a moment to read these posts - http://switchboard.nrdc.org/blogs/bnelson/.

Please let me know if you have any questions. You can reach me at my office – 415-875-6100 or by e-mail at bnelson@nrdc.org. I look forward to working with you.

Sincerely,

Barry Nelson
Senior Policy Analyst

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Marin Independent Journal
www.marinij.com

Marin Voice: Water reforms biggest step in years

By Gary Bobker and Barry Nelson
Posted: 12/21/2009 12:07:07 AM PST

ONE MONTH AGO, the Legislature passed, and the governor signed, a package of water reform bills. Since then, the new laws have inspired about as much misinformation as the health care debate in Congress.

The state administration hails the package as the long-awaited solution to California's water wars. Others, like Lynn Axelrod (Marin Voice, Dec. 11), call it a sell-out to corporate agriculture.

In fact, it's neither.

Instead, it's the first major step in decades by the Legislature to reform the outdated policies that have fueled the collapse of the Bay-Delta ecosystem, the closure of the state's salmon fishery, and increased the vulnerability of water supplies to climate change. The new laws do not reform every part of water policy - a simple reflection of political reality.

But make no mistake; this package points state water policy in a new and positive direction. Its passage is a testament to the persistence and vision of Assemblyman Jared Huffman and a few other legislators.

What does the package do?

It establishes a new Delta Stewardship Council, which will prepare a master plan to protect the Delta and coordinate the currently fragmented efforts of the many agencies that control Delta land use, water operations and flood management. It creates a new conservancy to restore critical habitat.

It sets a new state policy of reducing reliance on delta water supplies. The bills mandate aggressive state-wide urban water conservation, requiring other communities to make the investments in efficiency that Marin has made for years.

It also requires California, for the first time to measure groundwater levels state-wide. Any one of these provisions would be important, together, they're historic.

Among the most important provisions are new ecosystem protections, including a required first-ever comprehensive assessment of how much water is needed to protect the delta's public trust resources.

Our organizations have fought for two decades to secure this determination. Future plans for the delta are also required to meet the state's highest standards for endangered species recovery and habitat conservation.

Importantly, none of these reforms depend on passage of the $11 billion dollar water bond up for a vote next year.

Finally, although the package does not resolve the delta conveyance question, including the administration's proposed peripheral canal, it does raise the bar in several important ways: by requiring the state to protect public trust resources and restore endangered species by requiring the evaluation of alternatives to a canal; by prohibiting construction of any conveyance facilities until the state issues a permit with binding delta protections; and by requiring water exporters instead of taxpayers to pay for any new facilities. With these strong new protections, the most likely result is that less water will be pumped from the delta, not more.

True, the package includes only modest requirements for agricultural water conservation. But it requires the state to quantify agricultural efficiency, setting the stage for the development of numeric conservation targets in the future. It's an important first step.

These laws will not solve all of our state's water problems. More remains to be done to improve agricultural conservation, restore fisheries, and strengthen enforcement against illegal water diversions. But this package is a dramatic improvement over a status quo that is not working for the environment or water users.

There's a reason California was unable to pass major water reforms for decades: the issues are complex and fraught with political challenges. The reforms of 2009 happened because a few leaders were willing to step up, knowing that no one would be perfectly satisfied.

Assemblyman Huffman delivered for the public trust, and has earned the public's trust.

Gary Bobker is the program director at the Novato-based Bay Institute. Barry Nelson is a senior policy analyst at the Natural Resources Defense Council in San Francisco.

The San Diego Union-Tribune.

THE LAST RIVER

Tapping California's largest source of water

By Barry Nelson
May 30, 2008

There is only one river left to slake the thirst of California, as the nation's most populous state keeps growing. The state's other rivers are tapped out. We need this last great river more than ever as global warming threatens to make longer, drier droughts the norm throughout the West. But you won't find California's last river on any map because it's a virtual river. It doesn't exist as a physical river, but that doesn't make it any less real.

One needn't look far to find the virtual river. It's just a Google search away. State water managers have known about it for years. In fact, they put it in California's State Water Plan for anyone to see. And they identified it as the largest source of new water supply in California, the largest source by far. Simply put, the virtual river is a combination of water-use efficiency, water recycling, improved groundwater management and advanced urban runoff management. The virtual river dwarfs all other options.

Why tapping the virtual river is not the top priority of every water leader in California is another story. It's a story that needs to change. The San Francisco Bay-Delta is in trouble, an ecosystem in the midst of collapse. We can't squeeze more water from the Delta without forcing a cascading series of fish extinctions – from salmon to sturgeon to Delta smelt. That's not just bad for fish; it's bad for people. A Delta too sick to support its fisheries can hardly be relied upon for clean water supply. That's why Delta farmers see the Delta smelt as the canary in their coal mine.

The situation on the Colorado River is equally dire. After decades of taking more than its share, California has had to reduce its take from the river as the six other states in the river basin have reasserted their claims. As it is, the river is so overdrafted that it dries up before it reaches the sea. Now the record drought in the Southwest could empty Lake Mead. Many hydrologists predict this massive man-made reservoir will never be full again.

In the last century, pioneering engineers, with names such as Mulholland and O'Shaughnessy, tapped mighty rivers to provide water supplies, without which the Golden State would not be what it is today. The state and federal water projects are engineering marvels. They made California home to the nation's most vital agricultural region and enabled growth of the world's seventh-largest economy.

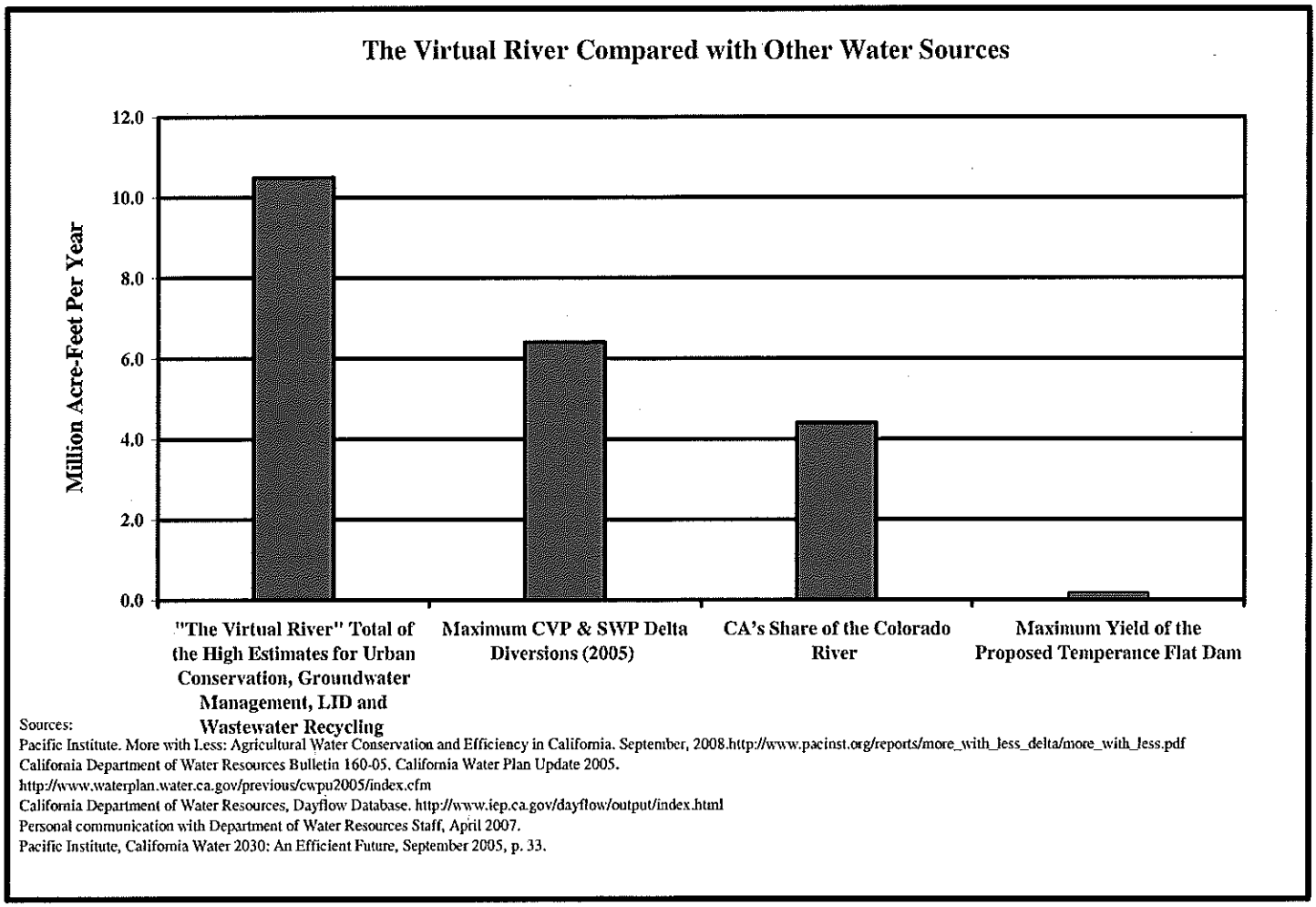
California's future depends on another feat no less astounding than the dam-building projects of yore. Making the most of the virtual river will require a whole new mindset. It will require recognition that every water drop saved – whether by conservation, recycling or groundwater and storm water management – counts as water supply. Those drops add up to more than 7 million acre-feet of water a year. That is more than has ever been exported from the Delta – the largest single source of water in the state. It is larger than the American, the Merced and the San Joaquin rivers combined. Environmentalists and urban water agencies agree that no other future source comes close to the virtual river.

The virtual river offers many other benefits. It can save energy and reduce global warming pollution because vast amounts of energy are currently needed to pump water from the Delta and the Colorado River. Moreover, the virtual river is less vulnerable to global warming; shrinking snowpacks and extended droughts will not affect its flow. One of its headwaters – advanced urban runoff management – can help clean up Southern California beaches by capturing storm water runoff before it picks up contaminants and pollutes our coastal waters. Finally, the virtual river can help us leave water in our real rivers, helping to save the Bay-Delta and our salmon fishing heritage.

Like the rivers that provide water for California's cities today, the virtual river will not simply flow to our doors. Success will require carefully designed policies and leadership from all levels -- from the governor, state and federal agencies, and the Legislature to regional and local water districts, local governments and individuals. Gov. Schwarzenegger's recent call for a reduction of California's per capita water use by 20 percent is an important first step.

We are at a turning point in water policy – and in California history. According to legend, Mark Twain once said that in California, "Whiskey is for drinking. Water is for fighting over." We have had our share of water wars in California. However, tapping into this virtual river is a task that can unite the state, ensuring our future water supply and finally proving Twain wrong.

■ Nelson is director of the Natural Resources Defense Council's Western Water Project.



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THE PRESS-ENTERPRISE

Delta Delusions

April 4, 2009

By Barry Nelson

Are you for or against the peripheral canal? In 1982, this was a meaningful question: Voters fearful of a thirsty Southern California rejected a proposal to divert additional water from the Sacramento River, around the San Francisco Bay-Delta Estuary, to the pumps in the southern delta. In the present day, our understanding of the risks facing the delta has changed.

In 2007, the Public Policy Institute of California released a report concluding there is a two-thirds chance of a catastrophic failure of delta levees by 2050, as a result of land instability, earthquake risk and sea level rise. Such a failure would threaten the region's residents and the environment. By drawing salty bay water into the delta, such a failure could also shut down pumping -- with serious implications for Southern California.

Second, the canal is now more a concept than a proposal. In fact, there is a remarkable diversity of ideas about a canal and alternatives to one. On one hand, the Public Policy Institute of California suggested that a canal could help reduce the vulnerability of water supplies to levee failure. Gov. Arnold Schwarzenegger's Delta Vision Blue Ribbon Task Force agreed in concept, and called for strong new environmental protections and agency reform.

Risks to the area around the Sacramento-San Joaquin Delta include a two-thirds chance of a catastrophic levee failure by 2050.

Neither the Public Policy Institute nor Delta Vision anticipated that a canal would produce much, if any, new water supply. In fact, both suggested that reductions in diversions might be needed. On the other hand, the Department of Water Resources has released a different concept for a canal that would weaken existing environmental standards and allow a dramatic increase in pumping -- negatively affecting the environment, delta agriculture and California's salmon fishing industry.

Hunches and faith

These very different proposals are the tip of the iceberg. Some have proposed that the "canal" should actually be a smaller pipeline. Others have advocated a thousand-foot-wide, unlined canal below sea level on vulnerable delta islands. Still others have

suggested armoring delta levees or an alignment on the west side of the delta, with a tunnel to deliver water to the pumps. The list goes on.

Different proposals would have dramatically different costs, water yield and impacts. Without detailed, carefully analyzed proposals, the canal debate is often founded on hunches, history and near-religious faith.

Moving this discussion in a more productive direction will require three things -- all of which are clearly outlined in the Delta Vision's strategic plan.

Three imperatives

First, water agencies must abandon the outdated assumption that a canal would produce more water. Southern California water agencies know this and believe that we must make a dramatic investment in the "virtual river" of water available through conservation, water recycling, urban storm-water capture and ground-water management, in order to meet future needs without more diversions from damaged ecosystems.

Second, careful analysis must address key questions. What size, design and alignment would perform best? How much water would be diverted? How would the project affect the environment? How would the facility fit into a strategy to protect residents and infrastructure? The answers matter, as the facility could cost $20 billion and take up to 20 years to build.

Third, the Legislature must reform the regulation of the delta water projects. Recently, those projects have been operated with little regard for environmental impacts or legal requirements. That's why state and federal courts have stepped in. Governance reform is essential to re-establishing trust that any facility would be operated responsibly.

Delta Vision addressed each of these issues, but the task force has no enforcement authority. It is now up to the governor, legislators, agencies and stakeholders to determine if this promising plan will be implemented or simply gather dust.

By following the road map laid out by the Delta Vision task force, we have a chance to resolve these critical issues, leading to more reliable water supplies and a healthier environment.

Barry Nelson is a resident of Berkeley and director of the Natural Resources Defense Council's Western Water Project.

http://www.pe.com/localnews/opinion/localviews/stories/PE_OpEd_Opinion_S_op_nelson_05_loc.4018b9c.html

American Rivers
The Bay Institute
Defenders of Wildlife
Environmental Defense Fund
Natural Resources Defense Council

CRITICAL ISSUES IN 2010 FOR THE BAY DELTA CONSERVATION PLAN

The Bay Delta Conservation Plan (BDCP) is at a critical point. Our organizations hope for the development of a Habitat Conservation Plan/Natural Communities Conservation Plan that will support recovery of the Delta's endangered species and habitats, and have devoted considerable resources to help ensure that the BDCP can serve as the HCP/NCCP vehicle. However, there are a number of critical outstanding issues that must be resolved if the BDCP is to be a success. The State Administration is pushing for a final plan and draft EIS/R by the end of 2010. However, in light of the issues raised below, this aggressive schedule is not likely to result in a credible, defensible product. A more realistic and deliberate approach, as outlined below, will produce lasting results faster then the state's current schedule.

Developing – and Using – Quantified Biological Objectives: Issuing a permit for a plan as ambitious as the BDCP in a system as complex as the Delta must depend primarily on the confidence that that plan is reasonably able to achieve specific, measurable, and clear objectives for recovery and restoration of the Delta's covered species and ecosystems. These quantified objectives, and associated performance targets and metrics, are a prerequisite to designing, evaluating and selecting the suite of conservation measures that will ultimately become the plan. Quantified objectives, targets and metrics are also necessary to measure how successful the plan's implementation is over time and to guide long-term adaptive management in the face of climate change, levee failure and other emerging threats to the Delta. Yet, the BDCP still lacks a comprehensive set of quantified objectives, targets and metrics. Developing quantified objectives – and revising the plan's conservation measures and other elements to ensure their attainment – must become a priority and a prerequisite for assembling an administrative draft of the Conservation Strategy and ultimately finalizing the BDCP, and adequate resources and time must be allocated to ensure this critical task is completed.

Complying with the State Legislature's Mandate for BDCP Guidance: In passing SB 7X 1 last fall, the California legislature established a number of requirements to guide and inform the development of the BDCP. Most notably, SB 7X 1 requires the State Water Resources Control Board to develop flow criteria to protect the Delta's public trust resources and the Department of Fish and Game to develop quantifiable biological objectives for the Delta. SB 7X 1 also requires that the BDCP fully evaluate a range of alternative capacities for dual or isolated conveyance facilities. The state legislature included these and other requirements for the explicit purpose of informing and guiding the BDCP process – but the current schedule does not allow for review and revision of the proposed BDCP conservation measures based on the SWRCB and DFG guidance or for thorough evaluation of alternative

conveyance capacities prior to the plan being finalized. To comply with the new state legislation, the final plan must reflect the new guidance and analysis, and provide adequate time in the BDCP schedule for doing so thoroughly and comprehensively.

Developing an Appropriate Project Purpose and Description: The current schedule is rushing forward with the NEPA/CEQA analysis before developing a clear project description and a sufficiently broad project purpose statement. As a result, many promising strategies for reducing conflict between ecosystem and water supply objectives may be overlooked. Currently, the BDCP only looks at actions in the Delta to meet its species/ecosystem recovery and water supply goals, but many of these goals could be most cost effectively addressed through actions outside the Delta including water conservation, reservoir reoperation, and habitat restoration. February 13, 2009 NOI project purpose statement provides clear and measurable direction regarding water supply objectives -- "to restore and protect the ability of the SWP and CVP to deliver up to full contract amounts" -- but only vague direction on ecosystem objectives. This creates an irresolvable tension that can only result either in a proposal to increase Delta diversions, potentially well beyond even the historic high levels of export that could harm the Delta ecosystem, or in a perceived failure to meet water supply expectations. This bias toward increasing overall Delta diversions appears contrary to the state legislature's direction in SB 7X 1 to reduce California's reliance on water exports from the Delta, develop a NCCP for the Delta, and consider a full range of operations.

Before further advancing the EIR/EIS, the project purpose and description should be revised and developed to properly balance water supply and ecosystem objectives in accordance with state law. The project purpose for water supply should focus on increasing the predictability of export operations and decreasing the physical vulnerability of project operations to disruption instead of focusing on simply increasing diversions. Furthermore, the Department of Water Resources and the Bureau of Reclamation should consider how the BDCP will help reduce reliance on Delta exports, particularly in dry years, through changes in water management inside the legal Delta and beyond. Failure to revise and develop the project purpose and description before evaluating the impacts of the proposed project will waste time and money and result in a poor quality work product.

Improving the Drafting Process: The pathway to a final BDCP is a confused one at best. The potential permit applicants, DWR and Reclamation, hold the water rights and operate the facilities that are at the core of the permit, and must manage these facilities to meet numerous statutory obligations under federal and state law. Yet the preparation of the BDCP itself is in the hands of the export contractors who receive water from DWR and Reclamation, and these parties – in the form of the BDCP Management Team -- are the primary decision-makers on project definition and analysis. Environmental and other stakeholders have less access to information and influence over decision-making. Furthermore, the schedule for completing the BDCP has set unrealistic expectations, resulting at times in draft products that have been characterized by poor quality, lack of clarity, and hasty review – and in repeated revision of the schedule as it becomes clear that deliverables are not ready. The BDCP is ultimately a decision to be made by DWR and Reclamation, the potential permit applicants, and the federal and state fish and wildlife agencies as the approving agencies. These agencies must

do more to control the process, improve the quality of the analysis, and better define how and what changes to project operations and water rights will be considered and analyzed., Going forward, the decision-making process should be structured to provide equal access to decision-making and information to a broad range of parties with a stake in how the Delta is managed, because the Delta is a vital resource to the people of California and the nation

January 17, 2010

Delta Blues

by Barry Yeoman

ISSUE: Fall 2008, FEATURE STORIES* | *August 28, 2008*

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Invader: Water hyacinth clogs a delta canal. Marcus Bleasdale

Drinking water for 23 million Californians. Lifeblood of our farm economy. Why it's so vital to save this Sacramento delta.

On this brisk, cloudless day, Tom Zuckerman and I are driving to his duck-hunting club on Rindge Tract, one of the low-slung rural islands that form the nucleus of California's Sacramento-San Joaquin Delta. With Zuckerman's two black Labradors kenneled in the back of his SUV, we bump along the rutted levee road that traces the curve of an inlet called Disappointment Slough. Below us lies a sunken cornfield, intentionally flooded after the harvest to attract migrating ducks like pintails and mallards. We pass an unused asparagus shed, but otherwise there's hardly a building in sight. A sign posted on a low fence warns visitors not to build outdoor fires: the soil is so rich in organic matter that it has been known to combust.

Once mostly tidal marsh, the 1,153-square-mile delta was tamed in the nineteenth century into isles of farmland laced with waterways. Rindge Tract, Zuckerman tells me, was co-owned by Herbert Hoover, who grew and processed spearmint here. As we drive, the bustle of northern California seems far away -- until a Panamanian cargo ship passes by at startlingly close range. "Right on time," says Zuckerman, a retired lawyer from an old delta farming family. The giant vessel glides by without a struggle, navigating a deepwater channel that leads to the landlocked Port of Stockton, 75 miles east of San Francisco and 50 miles south of the state capital, Sacramento.

It seems as if everywhere I drive in this inverted delta -- unlike conventional deltas, its broadest side faces away from the ocean -- there's another Escheresque twist or Roadside America absurdity. Huge cargo ships sail inland. Farms sit below sea level. Rivers run backward. The soil burns. Posters advertise a local SPAM festival. A hidden turnoff leads to Locke, a weathered rural Chinatown with a steakhouse called Al the Wops. The delta, along with San Francisco Bay, forms the largest estuary on the western coast of the Americas, yet for most Californians it remains unexplored and somewhat mysterious territory.

It is also territory of outsize importance. The delta serves as a vast switching yard for much of the state's water supply, including drinking water for 23 million people from the Bay Area to San Diego. Freshwater from its namesake rivers is channeled to two massive pumping stations, one owned by the state and the other by the U.S. Bureau of Reclamation. From the state facility, water enters a labyrinth of pipelines, tunnels, and canals, including the 444-mile-long California Aqueduct, that carries it to residential users. The federal pumps, meanwhile, divert water to the sprawling farms of the San Joaquin Valley, the core of U.S. fruit and vegetable production.

For all its value and beauty, though, the delta is also on the verge of collapse. Much of its land is kept artificially dry by 1,100 miles of jury-rigged levees that are inadequate to withstand a litany of growing stresses. First there's global warming, which could push sea levels two feet higher, or more, by century's end. Add to this the risk of flooding -- also linked to climate change -- as a result of increased rainfall and quicker snowmelt in the mountains. Finally, there's the growing chance of a devastating earthquake. Any of these phenomena could trigger a chain reaction of levee breaches, inundating farms and communities, displacing thousands of people, and sucking salt water deep into an already overstressed system. That, in turn, could leave Californians scrambling for freshwater for agriculture and residential consumption. In 2005 a respected study by the geologist Jeffrey Mount, director of the Center for Watershed Sciences at the University of California, Davis, and the environmental planner Robert Twiss added up the combined risks posed by earthquakes and floods and calculated a 64 percent chance that up to 20 levees will fail simultaneously within the next 50 years.

Some scientists draw parallels to the Gulf Coast just before Hurricane Katrina. "When I look at New Orleans and then turn and look at the Sacramento Delta, it's eerie," says Robert Bea, a professor of civil and environmental engineering at the University of California, Berkeley.

A more immediate crisis has already beset the delta, one that shows how deeply its ecological health and human welfare are entwined. Native fish populations -- salmon, steelhead, sturgeon, smelt -- are declining at such an alarming rate that the entire ecosystem appears to be in peril. Among the many culprits are the two pumping stations, which not only suck the fish into their machinery but also alter the region's underlying hydrology. The estuary's key indicator species, the delta smelt, is in such danger of extinction that in 2007 a federal judge limited the amount of water that could be exported from the delta during the months when the smelt was most vulnerable. San Joaquin Valley farmers, lacking sufficient water, say they let significant acreage go unplanted this year.

Those with a stake in the delta -- who live within its boundaries, study its wildlife, drink its water, or use that water for irrigation -- agree the place cannot sustain itself in its present state. That's where the consensus ends. Even basic scientific assumptions about the estuary's ecology are hotly disputed. So is the question of who should make the biggest sacrifices to rescue the delta, and California, from the brink of disaster.

It was once called a back swamp. As the tide rolled in and out, the delta's wetlands would flood, then dry out, exposing a complex terrain that befuddled early white visitors. In 1846, one of them, Edwin Bryant, described "a terraqueous labyrinth of such intricacy, that unskillful and inexperienced navigators have been lost for many days in it, and some, I have been told, have perished." Others navigated the delta more deftly: grizzlies and elk, sandhill cranes and tundra swans. Giant bulrushes called tules grew in dense clusters, and sycamores overhung the riverbanks.

In the mid-1800s, with a push from Congress, settlers began to "reclaim" the delta for agriculture. They drained the marshes, forming islands like Rindge Tract, then built soil levees (often using Chinese-American labor) to keep them from flooding. By the 1920s the delta looked pretty much the way it does today. The resulting farmland was incredibly fertile, producing crops like sugar beets and pears. The town of Isleton, on the delta's west side, was dubbed the Asparagus Capital of the World. In the 1950s its canneries exported more than 300,000 cases annually. But the organic soil is prone to oxidizing, compacting, and blowing away. As it disappeared, the islands began sinking until many were below sea level -- in some cases as much as 25 feet. This put pressure on the levees, which cracked and were periodically overtopped. Landowners patched the holes and piled on more dirt.

Meanwhile, California grew. The Stockton Deep Water Ship Channel was dredged through the delta in 1933, and incoming vessels introduced alien plants and animals that thrived in the altered ecosystem. And the state's drier regions began eyeing the delta thirstily. In 1951 the federal government finished building its pumping plant near the south delta town of Tracy, giving San Joaquin Valley farmers their first stable supply of irrigation water. The Tracy plant is enormous, its six pumps powered by enough juice to move more than 16 million cubic feet of water per hour. From there the water is lifted into a canal that runs 117 miles into the valley. In 1968 the state built a second facility, this one to serve California's booming south, including Los Angeles and San Diego. Some years, depending on the rainfall, the two stations divert enough water to flood 1,000 football fields more than a mile deep.

Despite all these changes, the delta remained a land in isolation. Marci Coglianese moved from San Francisco to Rio Vista, a town on the delta's western edge, in 1966. "It was like going back into the fifties," she says. "There was a clock face outside City Hall, but it had no hands. That was the perfect metaphor: Rio Vista was the town that time forgot." Even today, as we sit inside a downtown bakery, the town has a certain Route 66 feel. Outside Main Street's Striper Cafe, a neon sign depicts a striped bass peering dolefully at a martini glass.

At first, Coglianese couldn't wait to leave. But over time she fell captive to the subtleties of delta light. "What looked all tan and muddy green was actually a whole spectrum of colors," she says. When Isleton, five miles away, flooded in 1972, "everybody came out to try to save the levee," she recalls. Men slung sandbags. Women cooked for refugees who had crossed the Sacramento River to Rio Vista. "A lot of people had folks living in their backyards in travel trailers or took families into the house," she says. "I had never seen that kind of person-to-person connection." Coglianese not only stayed; she eventually became mayor, serving from 2000 to 2004.

In Rio Vista Coglianese found a community oriented to the water, one that celebrated its civic pride at a striped bass festival every year. "The fish were jumping," she says. "Old Man River was rolling along."

Stories abound about the thriving aquatic life in the mid-century delta. Roger Mammon, a sportfisherman active in delta wildlife issues, talks about an old-timer who as a child visited the San Joaquin River during the striped-bass spawn. "There were so many fish that the water would be white with their milt," Mammon tells me, using the technical term for the striper's sperm. By slapping a towel on the water, the old-timer's grandfather could trick males to the surface, then scoop them out with a net. Now, a day of fishing often yields just one or two bass.

Peter Moyle, a fish biologist at the University of California, Davis, is even more worried about the delta smelt, a tiny, translucent native fish that smells pleasantly like cucumbers. Declared threatened by the state and federal governments in 1993, the delta smelt has seen its numbers plunge 97 percent since then.

Because it evolved to live in one particular estuary and spends its entire life cycle in that system, the smelt is uniquely sensitive to changing delta conditions. Indeed, the same factors that have killed off the smelt are partly responsible for the collapse of other populations, including Chinook salmon, Central Valley steelhead, greentail sturgeon, and Sacramento splittail. This year, in an unprecedented move, the state and federal governments shut down California's commercial salmon fishery because of record low numbers.

Scientists point to many possible reasons for this free fall: toxic pesticides, shrinking rearing habitat, and the invasion of the overbite clam, which hogs the estuary's plankton. But the key suspects are the pumping stations that quench California's thirst. Pumping alters the natural flow of the delta, wreaking havoc with fish habitat. Not only that: the animals get lethally trapped in the pumps, which suck water with such force that they reverse the flow of two smaller rivers, the Old and the Middle.

The fish crisis goes beyond the delta's ecology: it has set off a legal chain reaction that affects both drinking water and food supplies. Last year, in response to a lawsuit filed by the Natural Resources Defense Council (NRDC) and four other organizations, U.S. District Judge Oliver Wanger restricted

pumping between December and June, when delta smelt venture nearest the pumps. In addition, in July 2008 he ordered federal and state water managers to come up with a plan to protect native salmon and steelhead.

Environmentalists say that by curtailing water exports, the rulings will improve the delta's water quality. But they acknowledge a flip side that needs California's attention: others are going without needed water. Particularly hard hit is the San Joaquin Valley, which the historian Kevin Starr once described as "the most productive unnatural environment on Earth." The valley's eight counties grow more than $20 billion worth of crops each year, more than the rest of California combined (and more than any other state, for that matter). This year, valley farmers left about 10 percent of their land -- some 200,000 acres normally devoted to tomatoes, peppers, and cotton -- unplanted because of delta water restrictions, according to Mike Wade, executive director of the California Farm Water Coalition. Several thousand additional acres were planted but later abandoned. "It's a dire situation," Wade says.

There is still a chance that the delta will dodge the bigger crisis -- a sudden, widespread levee failure. But a single natural disaster could alter the delta's landscape as thoroughly as Hurricane Katrina changed the Gulf Coast.

Most delta levees were not designed by engineers, and over the past century they have failed 166 times, usually affecting one island at a time. On a sunny day in 2004, the earthen levee protecting Jones Tract, west of Stockton, collapsed without warning, burying the island's asparagus and tomato farms under 12 feet of water. The force of the Middle River, as it poured across the breach, scooped out automobile-size chunks of peat. It took more than six months to pump out the water, which caused $90 million worth of damage and forced a three-day shutdown of both the state and federal export pumps.

A levee breach may cost California taxpayers from $20 million to $40 million to repair, says Jeffrey Mount, the geologist. And the Jones Tract incident was a single breach on one agricultural island. What would happen if multiple levees failed at once? And what if they failed on islands with larger populations?

According to geologists, northern California is ripe for an earthquake. The shock waves from the 1906 San Francisco earthquake -- with an estimated magnitude between 7.7 and 8.3 on the Richter scale -- reached the delta in less than half a minute. Back then, though, the delta was not as vulnerable as it is today. "In the 1906 quake, you could rest your arm on the levees because the islands hadn't subsided yet," Mount says. "Now the levees are 30 feet tall, on unstable foundations, and poorly constructed." The U.S. Geological Survey says there is a 62 percent chance that a tremor of at least 6.7 in magnitude will hit the Bay Area by 2032.

A strong earthquake could damage many levees at once, liquefying the sand beneath them by reducing the cohesion of the grains, and causing those levees to sag and fail. "Once water starts pouring over the top, that's an unstoppable force," Mount says. Because the islands are deep bowls, they would suck in a huge amount of water, much of it salty water from San Francisco Bay. Until that water could be flushed out -- no easy task -- the export pumps would have to be shut down, and farmers on the intact delta islands would not have freshwater for irrigation.

It wouldn't even take a trauma like an earthquake to destroy the levees. They could buckle under the incremental pressure caused by rising sea levels, which the Intergovernmental Panel on Climate Change predicts could reach 23 inches by 2100 (and more if the ice melt from Greenland and Antarctica accelerates). The delta could also be besieged by flooding as global warming melts California's mountain snowpack more rapidly and causes more precipitation to fall as rain rather than snow. A study published in the *Proceedings of the National Academy of Sciences* in 2004 predicted a reduction of up to 90 percent in the Sierra Nevada snowpack by century's end.

One California state government study estimated in 2007 that multiple levee failures could cost tens of billions of dollars and displace up to 35,000 of the delta's 400,000 residents. What makes this scenario all the more frightening is that parts of the delta no longer look like the sparsely populated Jones Tract, where the levee failed in 2004.

A 1992 California law divided the Sacramento-San Joaquin Delta into two zones with very different approaches to land use. In its rural center, known as the Primary Zone, new construction is sharply limited. Last March state regulators quashed plans for a 123-home neighborhood centered on an abandoned sugar-beet processing plant in the farm community of Clarksburg. This would have been the Primary Zone's first "urban" development, and opponents argued that it would harm the ecosystem and put new home owners at high risk for flooding.

Tracts closer to the periphery, in the so-called Secondary Zone, have few protections, though, as becomes clear on a drive through the small city of Oakley. Along Highway 4, billboards lined up like the old Burma-Shave signs beckon home buyers to brand-new subdivisions. In one of them, Summer Lake, residents are moving into two-story houses painted taupe and dark goldenrod as bulldozers clear the land around them for expansion. When finished, Summer Lake will include 1,330 new homes, a fire station, two public schools, and a 25-acre man-made lake. It's an attractive location for people who are priced out of the Bay Area and don't mind an hour's commute.

Hotchkiss Tract, where Summer Lake is being built, has the Anyplace, U.S.A. look of a rural patch primed for suburban development. Less apparent to the untrained eye is that Hotchkiss Tract sits below sea level. To protect the development, city officials authorized a ring of wide levees designed to withstand the type of flooding that comes once every 300 years. (This is tougher than federal requirements but pales next to the 10,000-year standard for cities in the Netherlands, which lies mostly below sea level.) "We have homes behind levees throughout the country," says city manager Bryan Montgomery. "We have homes in Tornado Alley, in Hurricane Row" -- in the Midwest and on Gulf Coast, respectively. "All those occurrences are far more likely than any kind of flooding in this area."

When Greenbelt Alliance, a Bay Area anti-sprawl group, challenged Oakley's flood protection plans, a state judge ruled with the city, clearing one of several obstacles to construction. But experts warn against too much confidence -- especially when extreme weather events are rendering terms like "100-year flood" virtually meaningless.

"If you ever hear anyone say they have designed something breach-proof, run," says Robert Bea, the Berkeley engineer. "Nature can always come up with a card that trumps your card." And John Cain, director of restoration programs for the San Francisco-based Natural Heritage Institute, warns, "When your house is below sea level and that levee breaks, it's the Ninth Ward."

There is no "single silver bullet" to solve the problems of the delta, says Barry Nelson, director of NRDC's Western Water Project. "We're going to need a portfolio of responses." Scientists, environmentalists, water managers, and farmers all favor the creation of managed floodplains -- chunks of agricultural land that seasonally collect excess floodwater, taking pressure off levees and reducing the risk of breaches. Not only do these "bypasses" lower flood levels, but they also make exceptional habitat for fish like salmon and steelhead. Farmers can still plant seasonal crops -- the flooding typically occurs in the winter -- and they get paid for accepting some risk of crop loss. The one existing floodplain in the delta, the Yolo Bypass, has helped keep nearby Sacramento, which sits just 17 feet above sea level, above water. This year NRDC negotiated with a developer to set aside land for a second bypass near the south delta town of Lathrop.

Not all the suggested fixes are so popular, though. Limiting development preserves habitat and decreases flood risks, but it also harms town governments that are desperate for property tax revenues. Idling or slowing the water pumps benefits fish, but it creates hardships for San Joaquin Valley farmers and Southern California water managers. Underlying any talk of solutions is a deeply contentious question: who makes the sacrifices necessary to save the delta?

One of the most compelling -- and most criticized -- voices in the debate belongs to Jeffrey Mount, the geologist. Impassioned and self-confident, he has become the de facto spokesman for an interdisciplinary team of researchers who have produced two major reports for the Public Policy Institute of California (PPIC). The reports generated considerable buzz when they were released in February 2007 and July 2008.

Mount and his colleagues argue that the delta's woes stem from efforts to keep it in its current state: a predictable freshwater system stripped of the physical complexity that defined it until the nineteenth century. Before human intervention, Mount says, "it must have been a maze of tule marshes, with thousands of channels in it." Today "the 1,100 miles of levees have utterly separated the water from the land."

Historically, Mount says, the delta was a "disturbance regime"; its plants and animals "evolved in a system that would occasionally get salty." A healthier delta, the PPIC says, would again change with the seasons, with fluctuations in the level of salt water flowing in and out. To bring this about, the PPIC recommends reengineering the delta to create a "mosaic" of interconnected habitats. This might include letting some levees fail -- particularly those closest to San Francisco Bay, which protect the most subsided and least valuable islands -- or intentionally breaching levees and allowing farmland to flood, compensating landowners for their losses. Mount acknowledges that some unflooded farmland would also have to be taken out of production as the delta gets saltier. He calls this a necessary trade-off but not a ruinous one: the six delta counties produce only 2 percent of California's farm sales. Mount warns that if humans don't reengineer the delta, nature will take it back in its own helter-skelter way.

This is where the debate grows contentious. Mount's critics, many of whom live in the delta, insist that the 2007 report misinterprets the science -- and that the delta was historically a freshwater system. Exhibit No. 1 for them is the work of Greg Gartrell, an environmental engineer with the Contra Costa Water District, which overlaps the delta. Gartrell has examined a century's worth of salinity records, along with studies that dated algae and seeds with carbon 14 to determine the estuary's historic salinity. "The past 100 years has been far saltier than any period in the last 800 years," he concludes.

The dispute remains unresolved. Tina Swanson, a biologist who heads the Bay Institute, a research and advocacy group that focuses on the delta and its surrounding watershed, served as an expert witness in the delta smelt lawsuit. She agrees with Gartrell that "historically, the delta may not have gotten all that salty." Even so, she says, letting it get periodically saltier "might not be a bad management tool." Creating a new disturbance regime, she says, could allow native species to flourish again and make it harder for invasive pests like the overbite clam to survive.

But local residents worry about the impact of salt water on today's delta, with its farm-based economy. "If ag goes down, these communities don't have any real reason to exist," says Marci Coglianese, the former mayor of Rio Vista. "I don't think the people that are sitting on the campus -- that aren't *down here* -- really understand the consequences of what they're proposing." She believes a more aggressive effort to shore up levees should be the first step toward protecting the delta. "There are ways to engineer out of this if you want to make the investment," she insists. The PPIC says that even with the $1.4 billion needed to upgrade the levees to meet federal standards, a "levees as usual" approach would have no guarantee of success.

Mount's proposal for a fluctuating delta has an even bigger consequence: because of periodic salt water intrusion, the delta would no longer be a reliable source of water for export. In its July 2008 report, the PPIC proposes two possible solutions. The one that would benefit the estuary the most, giving its fish populations the best chance to recover, is simply to end exports, letting the rest of California fend for itself. But the authors acknowledge that this would cost at least $1.5 billion a year and prove "catastrophic" to the state's farm economy. That's why they ultimately come down in favor of a second course, one that horrifies many delta residents: building a multibillion-dollar canal to divert freshwater away from the Sacramento River before it reaches the delta.

The logic is straightforward: with lawsuits and unstable levees threatening to shut down the pumps, the delta can no longer reliably provide water to outsiders. A canal would bypass this unstable system, guaranteeing uninterrupted deliveries to Southern California and the San Joaquin Valley. An alternative favored by some state planners would split the water between a peripheral canal and the current system.

Voters rejected a canal in 1982, but the proposal is again on the table, with the support of valley farm interests, Southern California water users, and Governor Arnold Schwarzenegger's administration. They

say the delta's precarious dirt levees pose too great a risk. "Do you want two-thirds of the people in the state of California to have their water supply solely predicated on something that was never engineered in the first place?" asks Jerry Johns, deputy director of the state Department of Water Resources. "As we go into the future, the threats are so large that we're going to have to consider some other system."

Mount and his colleagues say a peripheral canal, by decoupling the Tracy pumps from the delta, could potentially help the estuary's fish recover. Other advocates insist it's possible to build a canal while providing the delta with adequate freshwater, though they have offered no detailed plans. But those living in the delta don't believe the reassurances. They see the canal as a step toward their communities' abandonment. If the delta doesn't export water, they fear, it will lose its value to other Californians, and the state government would no longer have any incentive to maintain levees or control salt levels.

"The delta will be the region that's written off, like New Orleans," says Barbara Barrigan-Parrilla, who runs Restore the Delta, an unusually broad coalition of clergy, business leaders, farmers, sportfishermen, duck hunters, and environmentalists. State leaders have done little to allay those fears of abandonment. "Bluntly?" asks Roger Mammon, the fisherman (and Restore the Delta steering committee member), when I ask about the peripheral canal. "It could conceivably be the death of the delta."

That sentiment runs deep. Tom Zuckerman, the attorney, worries so much that a canal would mean "the end of agriculture" in the delta that he's willing to spend his retirement, and his savings, fighting it. "A lot of people I know in this area feel the same way," he says. "It's part of our blood here, and we're not going to sit by and allow a big transfer ditch to be built right through our midst."

The overriding dilemma here is that California is growing rapidly but its water supply isn't. Any long-term solution must be predicated on finding ways to use less water.

"When you look at the history of water development in California, there's a very clear pattern of growing cities looking for the next river to tap into," says Barry Nelson of NRDC, who works with Restore the Delta. "Over the course of the last decade, we've run out of rivers." Nelson talks about one remaining water source: a "virtual river" consisting of water saved by efficiency and reuse, along with captured storm water and cleaned-up groundwater. There are hints that state officials are coming around: Governor Schwarzenegger has called for a 20 percent reduction in per-capita urban water use by 2020. A similar measure is making its way through the state legislature.

Three years ago a detailed report by the Pacific Institute, an Oakland-based think tank, called for better land-use planning, higher efficiency standards for appliances like washing machines, improvements in crop irrigation, and better consumer education. Peter Gleick, the institute's president, says those changes can come about with little hardship and no new inventions. "But it's going to require more effort than we've put into water management," he says. "In the past we've always assumed, ‘Let's just find a new supply.' Well, if there's anything that the delta is telling us in its ecological death throes, it's that this paradigm has failed. There is no more unclaimed water."

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